

## Chapter 42

## Design Standards

### 42.1 General

This chapter defines the design standards that comply with the requirements of Title 23, USC Section 109(p) for Federal Highway Administration (FHWA) funded non-NHS public road projects on local streets and roads. The standards have been adopted by local agencies in accordance with RCWs 35.78 and 43.32 and apply to all arterial streets and roads. These standards cannot provide for all situations, but are intended to define the minimum elements for assistance to competent design professionals, without limiting innovation or creative engineering.

For FHWA funded projects, these standards apply to all non-NHS streets and highways on federal functionally classified streets and roads except for rural minor collector and local access roads. These standards have also been accepted by the Transportation Improvement Board (TIB) and the County Road Administration Board (CRAB) as the standards applicable to their funding programs.

To be eligible for federal funding, pavement depth shall be designed to provide an extended service life of 8 years and provide a minimum surfacing depth of 0.10 feet (30 mm) for structural deficiencies and 0.06 feet (18 mm) for correcting rutting skid resistance or other nonstructural problems.

The included text and tables illustrate the minimum standards that apply to most of the design elements for FHWA funded projects. For other items of design, refer to the WSDOT *Design Manual* (M 22-01) and the 2001 AASHTO publication “A Policy on Geometric Design of Highways and Streets” (Green Book). Design standards are provided in English and metric units to allow the designer a choice.

### 42.2 City and County Design Standards

Appendix 42.31 is incorporated into this manual for use in construction of local roads and streets. The statutory city and county design standards committee has adopted these publications for use on all public roads, classified as collector arterial or higher throughout Washington State. As updates are made by this committee, they will be included as an update to this manual.

### 42.3 Appendixes

#### 42.31 City and County Design Standards



# City and County Design Standards

for the Construction of Urban and Rural  
Arterials and Collectors

Adopted in 2002, per  
RCW 35.78.030 and RCW 43.32.020

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## ***Introduction***

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The City Design Standards Committee and the County Design Standards Committee, in accordance with RCWs 35.78.030 and 43.32.020, met to review and update the City and County Design Standards that were adopted in 1994 and that had been published in both English and metric units.

The revisions included in this document are: (1) the separate English units and metric units document that were previously published have been combined in this dual units document, (2) additional guidance references have been included for the Americans with Disabilities Act (ADA), and (3) resource information references (not design standards or guidance) are included for roundabouts and traffic calming.

National standards to utilize for roundabouts have not yet been developed. The committee will consider these after they have been developed. Traffic calming tools are generally applicable to local access streets and roads; however, some of these tools are being used on arterials, primarily low volume collectors. The resource listed identifies traffic calming tools.

These standards apply to new construction and reconstruction projects, 2-R and 3-R projects, and low volume road and street projects on routes with federal functional classifications as Principal Arterials, Minor Arterials, and Collectors.

The Local Agency Engineer may approve use of minimum AASHTO and related standards as contained in the references. Construction utilizing lesser standards than these must have the approval of the Washington State Department of Transportation (WSDOT) Operations Engineer, for Highways and Local Programs in accordance with RCW 35.78.040 or RCW 36.86.080 as appropriate.

In adopting these standards, the committees seek to encourage standardization of road design elements where necessary for consistency and to assure that motoring, bicycling, and pedestrian public safety needs are met. Considerations include safety, convenience, pleasant appearance, proper drainage, and economical maintenance. The committees recognize that cities and counties must have the flexibility to carry out the general duty to provide streets, roads, and highways for the diverse and changing needs of the traveling public.

These standards cannot provide for all situations. They are intended to assist, but not to substitute for, competent work by design professionals. It is expected that land surveyors, engineers, and architects will bring to each project the best skills from their respective disciplines. These standards are also not intended to limit any innovative or creative effort which could result in better quality, better cost savings, or both. An agency may adopt higher standards to fit local conditions. Special funding programs may also have varying standards.

The decision to use a particular road design element at a particular location should be made on the basis of an engineering analysis of the location. Thus, while this document provides design standards, it is not a substitute for engineering judgment.

Engineers should take into account all available information, including available funding, and use the professional judgment that comes from training and experience to make the final design determination. There should be some record, not necessarily formal or cumbersome, of the matters considered during the design process that justify decisions made regarding the final project design.


- I The 2001 AASHTO publication, “A Policy on Geometric Design of Highways and Streets” is referenced by page number, table, or figure number for design elements of the urban and rural highway. For those design elements not specifically identified, such as crown, superelevation, design speed, number of lanes, pavement design, intersection design, vertical clearance over walkway areas, etc., designers should refer to AASHTO.

## Committee Membership

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City Design Standards Committee RCW 35.78.020	County Design Standards Committee RCW 43.32.010	Other Participants
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These design standards were developed with the approval and authorization of:



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Alan O. King, PE  
Committee Chair  
Headquarters Highways and Local Programs





# Design Standards for New Construction and Reconstruction

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## Definitions

**Clear Zone.** The clear zone is the roadside border area starting at the edge of the traveled lane that is available for safe use by errant vehicles. The available clear zone is the distance, measured in feet (meters), normal to the highway beginning at the edge of the traveled lane to the closest part of any fixed object or nontraversable obstacles. Establishment of a minimum width clear zone is recommended. Rigid objects and certain other obstacles within the zone should be removed, relocated to an inaccessible position outside the minimum clear zone, remodeled to make traversable, breakaway, or shielded. Traffic control signs and luminaires with breakaway supports are not considered obstacles. All new construction and reconstruction projects should consider a minimum clear zone distance.

**Functional Classification.** The roadway classifications referred to in this manual are the Federal Functional Classifications shown on the official functional class maps prepared by the Headquarters Planning and Programming Office of WSDOT. |

**New Construction.** New construction is the building of a new roadway or structure on substantially new alignment, or the upgrading of an existing roadway or structure by the addition of one or more continuous traffic lanes.

**Reconstruction.** A reconstruction project involves major construction activity in excess of 3-R activity (see the Design Standards for 3-R Projects section). Reconstruction includes significant changes in cross section and/or shifts in vertical or horizontal alignment. If 50 percent or more of the project length involves significant vertical or horizontal alignment changes, the project will be considered reconstruction. Reconstruction may require acquisition of additional right-of-way, and may include all items or work usually associated with new construction. Reconstruction adds additional capacity for the through traffic lanes.

**Traveled Lane.** That portion of the roadway used for vehicle movement exclusive of the portion of the roadway width used or available for parking vehicles.

**Average Daily Traffic (ADT).** The general unit of measure for traffic defined as the total volume during a given time period (in whole days), greater than one day and less than one year, divided by the number of days in that time period.

**Design Hourly Volume (DHV).** The DHV is generally the 30th highest hourly volume (30 DHV) of the future year chosen for design. On the average rural road or arterial, DHV is about 15 percent of ADT. For urban areas, DHV is usually between 8 to 12 percent of the ADT.

**3-R.** Resurfacing, restoration, and rehabilitation of existing roadways with minimal changes to alignment or grade with no increase to capacity for the through traffic lanes.

**2-R.** Resurfacing and restoration of existing roadways by supplementing the existing road prism.

**Low Volume Roads and Streets.** For this document, a collector arterial or lower classified road or street with an ADT of less than 400.

## Roadway Geometrics

The following references provide design standards for the designer. The designer should read the text associated with the references and should also consider other related tables and text. Additional design references are in the References for New Construction and Reconstruction, 3-R, and 2-R Standards section.

Design Elements	References
	2001 AASHTO Green Book, "A Policy on Geometric Design of Highways and Streets."
Stopping Sight Distance	Stopping Sight Distance (wet pavement) Exhibit 3-1, page 112, and text on pages 425 (rural) and page 435 (urban). <u>AASHTO Design Guide Exception -- The desirable height of object for computing a stopping sight distance is 0.5 ft; the minimum is 2.0 ft.</u>
Passing Sight Distance	Single vehicle passing a single vehicle (Exhibit 3-7, page 124). Minimum passing sight distance single vehicle (Exhibit 3-7, page 124).
Roadway Approach/ Departure Sight Distance	Exhibit 9-50 through 9-70, pages 654-682, "Intersection sight distance."
Horizontal Curvature (Radius)	Exhibit 3-14, page 145, "Minimum Radius for Design of Rural Highways, Urban Freeways, and High-Speed Urban Streets Using Limiting Values of e and f."
Vertical Sag Curves	Exhibit 3-78, page 278 "Design Controls for Sag Vertical Curves - Open Road Conditions." Exhibit 3-79, pages 280, "Design Controls for Sag Vertical Curves."
Vertical Crest Curves	Exhibit 3-75, page 273, "Design Controls for Crest Vertical Curves – Open Road Conditions." Exhibit 3-76, page 274, "Design Controls for Stopping Sight Distance and for Crest Vertical Curves." Vertical Curves Based on Passing Sight Distance."
Vertical Grade	Exhibit 6-4, page 427, "Maximum Grades for Rural Collectors." Exhibit 6-8, pages 436, "Maximum Grades for Urban Collectors."

## Bridge Criteria

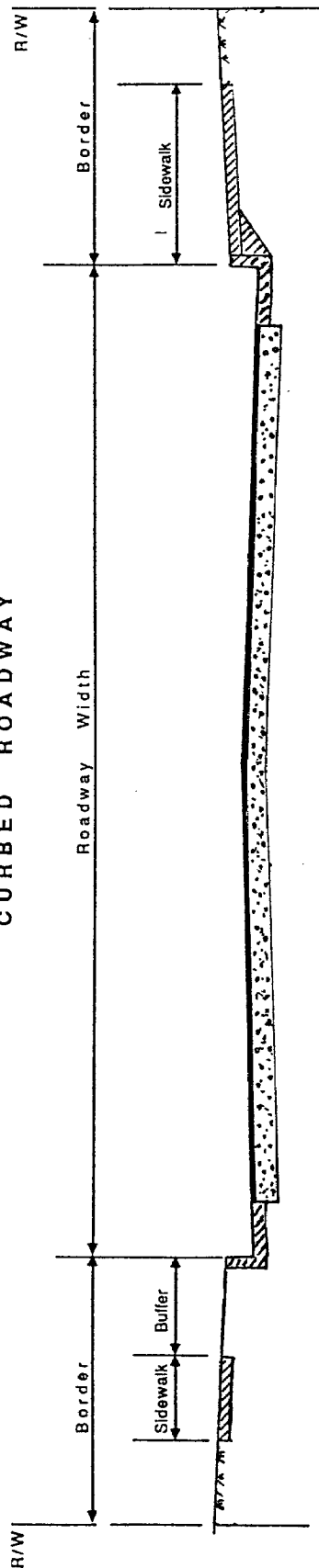
Design Elements	References
Bridge Width	The minimum bridge width for two-way structures is the greater of: (1) the design roadway width, or (2) the existing roadway width.
Loading	HS 25-44 (for federally funded projects), others may use HS 20-44.
Vehicular Railing	AASHTO Crash Tested Rail, or Approved Crash Tested Rail.
Pedestrian Railing	AASHTO.
Approach Railing	AASHTO Crash Tested Rail, or Approved Crash Tested Rail.
Vertical Clearance	16.5 feet minimum.

## Other Criteria

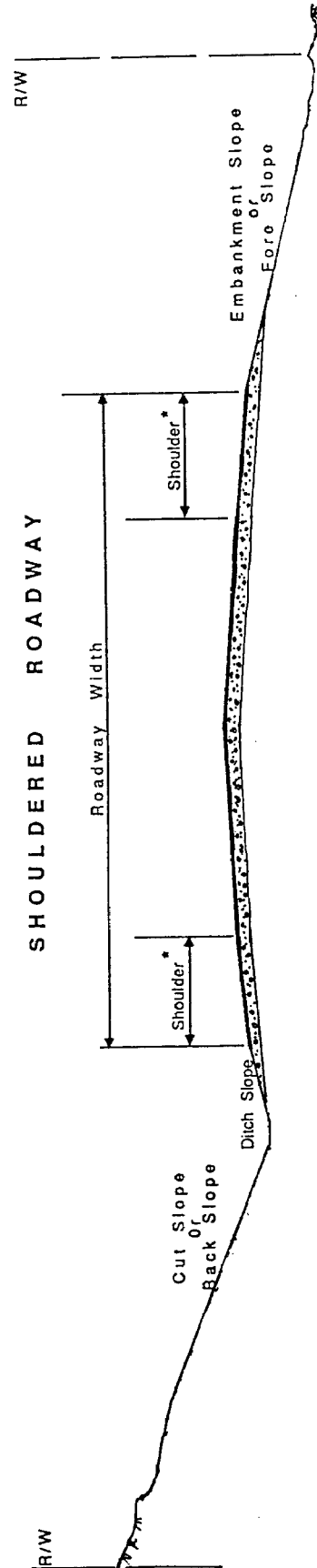
Design Elements	References
Bicycle	Chapter 1020 of the WSDOT <i>Design Manual</i> (RCW 35.75.060 and 36.82.145).
Signing	MUTCD, as modified by the Washington State Transportation Commission per RCW 47.36.030.
Americans with	Code of Federal Regulations 28 CFR Part 36, Interim Final Rules <b>Disabilities Act-1990</b> U.S. Department of Justice <b>ADA</b> The Architectural and Transportation Barriers Compliance Board WSDOT/APWA Standard Plan F-3 <u>Current</u> Uniform Building Code, Washington State Amendments.
Sidewalks	Sidewalk Details, A Guide for Washington Local Agencies, Tribes and Nations, March 2001.
Low Volume Roads	<u>2001 AASHTO Geometric Design of Very Low Volume Local Roads (ADT <math>\leq</math> 400)</u>

## DEFINITION OF ROADWAY ELEMENTS

### CURBED ROADWAY



### SHOULDERED ROADWAY



\* Does not include widening for guard rail or other special purposes.

# Geometric Cross-Section for Two-Way Roads and Streets (English Units)

Design Standards	Arterial											
	Principal <sup>(h)</sup>			Minor <sup>(h)</sup>				Collector <sup>(h)</sup>				
	Curbed <sup>(d)</sup>	Shouldered		Curbed <sup>(d)</sup>	Shouldered			Curbed <sup>(d)</sup>	Shouldered			
	DHV All	DHV Below 200	DHV 200 and Over	DHV All	DHV Below 100	DHV 100 to 200	DHV 201 and Over	DHV 400 and Over	ADT 400 to 750	ADT 751 to 1000	DHV 100 to 200	DHV 201 and Over
Right-of-Way	Not less than required for all design elements.											
Roadway Width <sup>(a)(b)(g)(i)</sup>	24 ft	36 ft	40 ft	24 ft	32 ft	36 ft	40 ft	24 ft	26 ft	28 ft	34 ft	40 ft
Lane Width:												
(A) Exterior <sup>(b)(i)</sup>	12 ft	12 ft	12 ft	12 ft	12 ft	12 ft	12 ft	12 ft	10 ft	10 ft	11 ft	12 ft
(B) Interior Thru <sup>(b)</sup>	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	10 ft	10 ft	11 ft	11 ft
(C) 2-Way Left Turn <sup>(b)</sup>	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	10 ft	10 ft	11 ft	11 ft
(D) Exclusive Turn <sup>(b)</sup>	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	11 ft	10 ft	10 ft	11 ft	11 ft
(E) Parking	10 ft <sup>(c)</sup>			10 ft <sup>(c)</sup>					(e)			
Shoulder Width <sup>(f)(g)(i)</sup>		6 ft	8 ft		4 ft	6 ft	8 ft		3 ft	4 ft	6 ft	8 ft
Clear Zone/Side Slopes	AASHTO (j)											
Ditch Slope (in slope)	Slopes steeper than 4:1 should only be used when achieving a 4:1 slope is impractical.											

(a) For curbed, distance from face of curb to face of curb. For shouldered, distance from outside edge to outside edge of shoulder.

(b) May be reduced to minimum allowed by AASHTO.

(c) 8 feet may be acceptable when the lane is not likely to become a traffic lane in the foreseeable future.

(d) Curbed section is appropriate for urban setting.

(e) Industrial areas 8 feet to 10 feet. Residential areas 7 feet to 10 feet.

(f) When guardrail is necessary, provide 2 feet of widening or longer posts to ensure lateral support.

(g) For roads with traffic volumes of less than 400 ADT, the low volume road and street standards may be used.

(h) Federal functional classification defined by WSDOT (Planning and Programming Service Center).

(i) For guidance for one-way streets, see AASHTO, and the 1991 uniform fire code.

(j) When using AASHTO guidance for clear zone determinations, the designer should take into account all AASHTO materials relating to clear zone and project circumstances.

**Note:** Where adequate traffic data is not available to determine DHV, a conversion may be made as follows:  
 $DHV = (.08 \text{ to } .12) \times ADT$  to change ADT to DHV

<b>New Sidewalks (when provided)</b>	<ul style="list-style-type: none"> <li>• <b>Minimum Width</b> — 60 inches continuous clear width or 36 inches clear width with 60 inch by 60 inch clear passing spaces at 200-foot minimum intervals.</li> <li>• <b>Surface</b> — Firm, stable, and slip resistant.</li> <li>• <b>Crossslopes</b> — 1:50 (2%) maximum.</li> <li>• <b>Running Slope</b> — Minimum feasible slope consistent with slopes established by the adjacent roadway.</li> <li>• <b>Buffer</b> — Separation from vehicular ways by curbs or other barriers.</li> </ul> <p><b>Note:</b> For temporary work or alterations to existing sidewalks or pedestrian facilities, refer to ADA rules. For pedestrian paths off public rights-of-ways, the designer should refer to uniform building codes and WAC 51-30 for the appropriate standards.</p>
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# Design Standards for 3-R Projects

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## Definitions

**Resurfacing.** The addition of a layer or layers of paving material to provide additional structural integrity or improved serviceability and rideability.

**Restoration.** Work performed on pavement or bridge decks to render them suitable for an additional stage of construction. This may include supplementing the existing roadway by increasing surfacing and paving courses to provide structural capability, widening up to 10 feet (3 m), including lane and shoulder width, and should include the installation of localized safety improvements. Restoration will generally be performed within the existing right-of-way.

**Rehabilitation.** Similar to “Restoration” except the work may include, but is not limited to, the following:

- Reworking, strengthening, or removing and replacing the base and/or subgrade.
- Recycling or reworking existing materials to improve their structural integrity.
- Adding underdrains.
- Replacing or restoring malfunctioning joints.
- Substantial pavement under-sealing when essential for stabilization.
- Pavement grinding to restore smoothness, providing adequate structural thickness remains.
- Removing and replacing deteriorated materials.
- Crack and joint sealing but only when the required shape factor is established by routing or sawing.
- Improving or widening shoulders.

Rehabilitation may require acquisitions of additional right-of-way.

**Safety Improvements.** Some safety improvements are normally included in 3R projects. During project development, a generalized roadside evaluation should be prepared to identify those high priority roadside elements to be considered for mitigation. Safety improvements include:

- Upgrading existing substandard roadway design elements — roadway design elements are the physical characteristics of the roadway such as alignment, grades, widths, sight distance, clearances, bridges, and the pavement structure including surface texture.
- Improving existing operational features — operational features include traffic control devices, left and right turn lanes, lighting, bicycle, and pedestrian accommodations that provide for the safe and efficient movement of vehicles, bicycles, and pedestrians.
- Reducing the potential hazard of existing roadside features — roadside features include sideslopes, ditches, drainage facilities, barrier systems, sign supports, luminaires, trees, utility poles, and other features adjacent to the roadway.

- Upgrading bridge safety features to include protection at all bridge ends by use of — bridge rails, approach rails, connections, and terminals are considered bridge safety features.
- Upgrading substandard superelevation.

## General Discussion

Funding restrictions and other considerations do not always allow improvement of all existing roads and streets to the standards desirable for new construction. Therefore, when pavement condition deteriorates to the level of minimal standards, a cost-effective pavement improvement is needed.

A project becomes 3-R when the proposed improvement consists of resurfacing, restoration, or rehabilitation to preserve and extend the service life of the roadway, or enhances the safety of the traveling, bicycling, and/or walking public.

3-R projects primarily involve work on an existing roadway surface and/or subsurface. Their purpose includes extending the service life, providing additional pavement strength, restoring or improving the original cross-section, increasing skid resistance, decreasing noise, improving the ride of the roadway, and enhancing safety.

Many factors influence the scope of 3-R projects, including:

- Roadside conditions.
- Funding constraints.
- Environmental concerns.
- Changing traffic and land use patterns.
- Deterioration rate of surfacing.
- Accidents or accident rates.

Normally, all 3-R improvements are made within the existing right-of-way, although acquiring right-of-way and/or easements should be considered when and where practical.

Each 3-R project should be considered in context with the entire route between logical termini and within the constraints imposed by limited funding and other considerations.

As a minimum, normally include the following for a 3-R project:

- Guardrail end treatments upgraded to current standards.
- Appropriate transition and connection of approach rail to bridge rail.
- Beveled end sections for both parallel and cross-drain structures located in the clear zone.
- Relocating, protecting, or providing breakaway features for sign supports and luminaires.
- Protection for exposed bridge piers and all abutments.
- Modification of raised drop inlets which present a hazard in the clear zone.



It is desirable to provide a roadside clear of fixed objects and nontraversable obstacles. The priority for action relative to roadside obstacles is: (1) eliminate, (2) modify, and (3) protect.

On all projects which include structures with deficient safety features, consideration must be given to correcting the deficient features. When complete upgrading is not practical, a partial or selective upgrading and/or other improvements should be considered to mitigate the effects of the substandard elements.

# Design Standards for 2-R Projects

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## General

Funding restrictions do not always allow improvement of existing roadways to the standards desired. Therefore, when pavement condition reaches a minimal condition, cost effective pavement improvements are needed.

Resurfacing and restoration (2-R) projects involve work to restore the existing roadway surface and appurtenances for safe and efficient highway operation. This type of project provides for resurfacing of the existing roadway to provide structural adequacy, to restore the roadway surface condition, and to consider making minor safety improvements.

Major improvements are not the intent of this type of project. In addition to 2-R allowing for maintenance overlays for preservation of the roadway, a 2-R project is defined as:

**Resurfacing.** The addition or replacement of a layer of paving material to provide additional structural integrity or improve serviceability and rideability.

**Restoration.** Work performed on either pavement sections or bridge decks to render them suitable for an additional stage of construction. This may include supplementing the existing roadway by increasing surfacing and paving courses to provide structural capability and minor shoulder widening to provide roadway section continuity. Restoration will generally be performed within the existing right-of-way.

## Design Parameters

1. **Traveled Way and Roadway Width.** Resurfacing of the roadway will normally be to the existing width. This should consider paving of previously unpaved shoulders. If short lengths of narrower lanes or shoulders exist within the project limits, widening should be considered to provide roadway section continuity within the project limits.

2. **Pavement**

- a. The existing pavement may be structurally adequate, but may require an overlay to correct other types of deficiencies. An 0.7 inch (18 mm) minimum depth of paving material should be used to correct deficiencies such as rutting, skid resistance, etc.

If a general structural deficiency exists, the design service life minimum of eight years shall be used to determine the solution. A minimum depth of 1.2 inches (30 mm) is required for any structural deficiency in the surface.

- b. To the extent feasible, achieve standard superelevation by adjusting surfacing depth.

3. **Safety Improvement.** Some safety improvements are normally considered in 2-R projects. During project development, a generalized roadside evaluation should be prepared to identify those high priority roadside elements to be considered for mitigation.

All high accident locations should be evaluated for treatment.

All signing and pavement markings shall be updated in compliance with the MUTCD.

The items below, in conjunction with the accident history and funding availability, should be considered in developing the project:

- Evaluate Bridge approach guardrail — The transition and attachment to all the bridge ends should be brought up to current standards. The leading or trailing guardrail ends should be upgraded if there is no existing approach guardrail, new approach guardrail should be installed on all bridge ends to the current standards. Evaluate bridge barrier systems. Consideration should be given to upgrades.
- Rail/Deck/Post Elements
- Approach Transitions
- Wood Elements (should be particularly considered for upgrades.)
- Remove unneeded guardrail.
- Upgrade all guardrail ends. The preferred upgrade would be to the current standards.
- Relocate, protect, or provide breakaway features for sign supports and luminaires inside the clear zone.
- Adjust utilities for location with clear zone standards.
- Add or update traffic barriers/guardrail.
- Beveling or extend culverts.
- Slope flattening/ditch.
- Add channelization and/or illumination.
- Improve sight distance.

## ***References for New Construction and Reconstruction, 3-R, and 2-R Standards***

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The designer may use the standards and rationales incorporated into the following manuals (see the following page for addresses to acquire reference materials).

### ***AASHTO***

- A Policy on Geometric Design of Highways and Streets, 2001 Edition.
- Guide for Design of Pavement Structures
- Highway Drainage Guidelines
- Guide for Roadway Lighting
- Roadside Design Guide

### ***Transportation Research Board (TRB)***

- Highway Capacity Manual

### ***Washington State Department of Transportation (WSDOT)***

- Standard Specifications for Road, Bridge, and Municipal Construction
- Supplement to MUTCD (WAC 468-95)
- Bridge Design Manual
- Highway Hydraulics Manual
- Standard Plans for Road, Bridge, and Municipal Construction
- Design Manual (except for 2R/3R)
- Pavement Design Manual
- A Guide for Local Agency Sidewalk Details, WSDOT Headquarters Highways and Local Programs, Washington State Technology Transfer Center

### ***Institute of Transportation Engineers (ITE)***

- Traffic Engineering Handbook

### ***FHWA***

- Manual of Uniform Traffic Control Devices (MUTCD)

### ***ADA***

- Federal/Register, June 20, 1994, Interim Final Rules, 36 CFR-Part 1191 Architectural and Transportation Barriers Compliance Board
- 1994 Uniform Building Code, Washington State Amendments

### ***Roundabouts***

- NCHRP Synthesis 264 — Modern Roundabout Practice in the United States, Transportation Research Board
- FHWA — Roundabouts, An Informational Guide
- WSDOT *Design Manual*, Chapter 915

### ***Traffic Calming***

- A Guidebook for Residential Traffic Management, Final Report, December 1994, WSDOT Highways and Local Programs Service Center, Washington State Technology Transfer Center

## **Addresses to Acquire Reference Materials**

<b><i>AASHTO</i></b>	American Association of State Highways and Transportation Officials 444 North Capitol Street NW, Suite 249 Washington, DC 20001 (202) 624-5800 (202) 624-5806 (fax)
<b><i>TRB</i></b>	Transportation Research Board National Research Council 2101 Constitution Avenue NW Washington, DC 20418
<b><i>WSDOT</i></b>	Engineering Publications Department of Transportation Transportation Building, Room SD3 Olympia, WA 98504-7400 (206) 705-7430 (206) 705-6808 (fax)
<b><i>ITE</i></b>	Institute of Transportation Engineers 525 School Street SW, Suite 410 Washington, DC 20024 (202) 554-8050 (202) 863-5486 (fax)
<b><i>MUTCD</i></b>	Superintendent of Documents U.S. Government Printing Office Washington, DC 20402
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